

What is claimed is:

1. An optical pickup apparatus of an information-recording medium comprising:

- 5        a light source;
- an optical system for condensing a light emitted from said light source;
- a focus controller for controlling said optical system to form a light spot on
- an information-recording medium;
- a photo-detecting device for detecting a light beam reflected from the
- 10      information-recording medium;
- a processing device for processing signals of the plurality of light beam detected by said photo-detecting device to supply a tracking error signal and a tilt information signal;
- a tracking controller for controlling said optical system according to the
- 15      tracking error signal to make the light spot follow an information track formed on
- the information-recording medium; and
- a tilt controller for compensating the tilt of the information-recording
- medium according to the tilt information signal;
- wherein the photo-detecting device is divided into pluralities of regions
- 20      which are defined by a vertical, horizontal and diagonal lines centering on the
- central position of the photo-detecting device and wherein the vertical line is
- parallel to a track of the information medium.

2. The apparatus of claim 1, wherein the photo-detecting device has

25      eight regions that is evenly divided in size, and wherein signals detected in said

regions are designated by A1, A2, B1, B2, C1, C2, D1 and D2 starting from seventh octant of the eight regions.

3. The apparatus of claim 2, wherein the processing device produces  
5 two push-pull signals P1 and P2, where  $P1 = (A1 + D1) - (B1 + C1)$  and  $P2 = (A2$   
+ D2) – (B2 + C2); and outputs the tilt information signal T according to a following  
equation:

$$T = P1 - k * P2$$

wherein k is a constant to minimize the influence of a radial shift.

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4. The apparatus of claim 1, further comprising a hologram means  
installed on an optical path of the light beam reflected from the information-  
recording medium.

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5. A tilt detecting method of an information-recording medium  
comprising the steps of:

detecting a light amount signal of a region having a large change in a light  
amount and a light amount of a region having a small change in a light amount  
according to a tilt amount of the information-recording medium, by means of a  
20 photo-detecting device;

calculating a push-pull value of each region; and

removing an influence of a radial shift by using the two push-pull values  
and obtaining a tilt information;

wherein the photo-detecting device is divided into pluralities of regions  
25 which are defined by a vertical, horizontal and diagonal lines centering on the

central position of the photo-detecting device and wherein the vertical line is parallel to a track of the information medium.

6. The method of claim 5, wherein, in the step of detecting a light amount signal, the reflected light reflected from the information-recording medium is divided into regions that are left and right sides of the vertical lines, and a light amount of a region having a large difference in a light amount and a light amount of a region having a small difference in a light amount.

10 7. The method of claim 5, wherein, the step of calculating a push-pull value comprises:

obtaining a difference between the light amount signals that are detected from the left and right sides of the vertical lines having a large change in a light amount, to obtain a first push-pull value; and

15 obtaining a difference between the light amount signals that are detected from the left and right sides of the vertical lines having a small change in a light amount variation, to obtain a second push-pull value.

8. The method of claim 5, wherein the step of obtaining the tilt information comprises:

multiplying one of the push-pull values by a constant;

subtracting the multiplied push-pull value from the other push-pull value;

determine the constant to minimize the influence of a radial shift; and

outputting the tilt information from the subtraction result with substituting

25 determined constant into the subtraction.

9. A tilt detecting method of an information-recording medium comprising the steps of:

dividing a light reflected from an information-recording medium to a left  
5 and a right regions, dividing the left and the right regions to a region having a large  
change in a light amount and a region having a small change in a light amount;

obtaining a difference between a sum of the left light amount of the region  
and the sum of the right light amount of the region having the large change in a  
light amount, and obtaining a first push-pull value;

10 obtaining a difference between a sum of the left light amount of the region  
and the sum of the right light amount of the region having the small change in a  
light amount, and obtaining a second push-pull value;

15 multiplying the second push-pull value by a constant, subtracting the result  
value from the first push-pull value, and obtaining a push-pull value depending  
only on a tilt amount; and

subtracting the push-pull value from a tracking error value and detecting a  
tilt value;

wherein the photo-detecting device is divided into pluralities of regions  
which are defined by a vertical, horizontal and diagonal lines centering on the  
20 central position of the photo-detecting device and wherein the vertical line is  
parallel to a track of the information medium.

10. The method of claim 9, wherein the first push-pull signal is  
obtained from a difference between a light amount of the region having a relatively  
25 large change in a light amount in the upper portion or the lower portion of the left

region of the reflected light and a light amount of a region having a relatively large change in a light amount in the upper portion or the lower portion of the right region of the reflected light.

5           11. The method of claim 9, wherein the second push-pull signal is obtained from a difference between a light amount of the region having a relatively small change in a light amount in the upper portion or the lower portion of the left region of the reflected light and a light amount of a region having a relatively small change in a light amount in the upper portion or the lower portion of the right region of the reflected light.

10           12. A tilt detecting method of an information-recording medium comprising the steps of:

15           detecting pluralities of light signals received a photo-detecting device arranged in a light receiving path; wherein the photo-detecting device is divided into eight regions which are defined by a vertical, horizontal and diagonal lines centering on the central position of the photo-detecting device and wherein the vertical line is parallel to a track of a information medium; and wherein signals detected in said regions are designated by A1, A2, B1, B2, C1, C2, D1 and D2  
20 starting from seventh octant of the eight regions;

calculating push-pull signals P1 and P2; wherein  $P1 = (A1 + D1) - (B1 + C1)$  and  $P2 = (A2 + D2) - (B2 + C2)$ ; and

outputting a tilt information signal T according to a following equation:

$$T = P1 - k * P2$$

25           wherein k is a constant to minimize the influence of a radial shift.

13. The method of claim 12, wherein the constant k is a value that satisfies a condition where no variation in the tilt information signal T is found even when there is an intentional radial shift.

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14. The method of claim 12, further comprising a step of compensating a tilt of the information-recording medium according to the tilt information signal T by substituting the constant k in the equation.

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